

AD-A238 072



2

DOT/FAA/AM-91/8

Office of Aviation Medicine
Washington, D.C. 20591

Some Personality Characteristics of Air Traffic Control Specialist Trainees: Interactions of Personality and Aptitude Test Scores with FAA Academy Success and Career Expectations

Lendell G. Nye
William E. Collins

Civil Aeromedical Institute
Federal Aviation Administration
Oklahoma City, Oklahoma 73125

May 1991

Final Report

This document is available to the public through
the National Technical Information Service,
Springfield, Virginia 22161.



U.S. Department
of Transportation
Federal Aviation
Administration

DTIC
ELECTE
JUL 11 1991
S B D

151 91-04680



DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

91 7 10 151

NOTICE

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

1. Report No. DOT/FAA/AM-91/8	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Some Personality Characteristics of Air Traffic Control Specialist (ATCS) Trainees: Interactions of Personality and Aptitude Test Scores with FAA Academy Success and Career Expectations		5. Report Date May 1991	
		6. Performing Organization Code	
7. Author(s) Lendell G. Nye, B.A. and William E. Collins, Ph.D.		8. Performing Organization Report No.	
9. Performing Organization Name and Address FAA Civil Aeromedical Institute P.O. Box 25082 Oklahoma City, OK 73125		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address Office of Aviation Medicine Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplementary Notes This work was performed under task AM-C-91-HRR-123			
16. Abstract The State-Trait Personality Inventory (STPI) is a self-report inventory which measures anxiety, curiosity, and anger (Spielberger, 1979). The three 'trait' scale scores are determined by the frequency of each emotion as stable personality constructs. The Multiplex Controller Aptitude Test (MCAT) is the primary selection test completed by ATCS applicants. The STPI was given to 1,284 students who entered the FAA Academy nonradar screen program between October 1986 and September 1987. Men and women ATCS trainees exhibited less anxiety and anger than normative groups of college students and Navy recruits. Also, in most comparisons, the ATCS sample indicated greater curiosity. ATCS pass rates were reduced within each MCAT score level for the groups of entrants with anxiety or anger scores above the normative levels. Personality trait profiles differed significantly for groups when they were categorized by both self-expected job performance levels and job satisfaction, but not aptitude score levels. Analyses indicated significant relationships between anxiety and lower job performance self-expectations and between curiosity and higher self-expected job satisfaction. FAA Academy entrants have a group profile indicating relatively low levels of trait anxiety and anger. Personality factors can impact a) the predictive validity of the MCAT in determining a student's aptitude for learning air traffic control principles/procedures and b) potentially, organizational goals such as increasing employee job satisfaction.			
17. Key Words Training Personality Anxiety		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 16	22. Price

SOME PERSONALITY CHARACTERISTICS OF AIR TRAFFIC CONTROL SPECIALIST (ATCS) TRAINEES: INTERACTIONS OF PERSONALITY AND APTITUDE TEST SCORES WITH FAA ACADEMY SUCCESS AND CAREER EXPECTATIONS

INTRODUCTION

For this study, the STPI- State-Trait Personality Inventory (Spielberger, 1979) was the personality measure used to examine three issues. The STPI is a self-report instrument comprised of scales, which measure the personality dimensions of anxiety, curiosity, and anger. The scores for the three "trait" subscales for the emotions of anxiety, curiosity, and anger are determined by the self-reported frequency of each emotion and are considered to be indicators of stable personality constructs. By contrast, the "state" subscales ask the respondent to indicate how he/she feels at the present time. Generally, anxiety is defined by subjective feelings such as nervousness, tension, insecurity, and lack of self-confidence. Anger is described by terms such as irritation, rage, and lack of self-control. The personality dimension of curiosity is related to descriptors such as inquisitive, eager, stimulated, and mentally active.

The first question examined whether there were personality differences between men and women on the STPI dimensions and also compared the STPI results of our sample of FAA Academy entrants with normative group data. Gender differences on the Sixteen Personality Factor Questionnaire (16PF, Cattell, 1970) were examined (Karson & O'Dell, 1974) and the conclusion made that the factor structures of the 16PF scales for men and women Air Traffic Control Specialist (ATCS) applicants were very similar. Examining their descriptive statistics, only on the 'I' scale (tender-mindedness) was the gender group effect size (d statistic) found to reach Cohen's (1969) classification for a "large" difference between gender groups. In a previous study (Collins, Schroeder, & Nye, 1989), both trait anxiety and state anxiety scores of FAA Academy entrants were lower than normative groups of college students and Navy personnel in flight training. Gender differences in trait anxiety were found in the normative group of college students and also in a study of community volunteers (Stoner & Spencer, 1986); with women indicating higher levels of trait anxiety in both studies.

The second purpose of this study was to determine the nature of the relationships between expressed personality characteristics and attitudes regarding

future job satisfaction as ATCSs. The FAA has been monitoring facets of employee job satisfaction using the Job Satisfaction Survey (Myers, Schroeder, VanDeventer, & Collins, 1988) since 1984 and has been using those survey findings to meet its perceived responsibilities to implement organizational changes leading to increased employee job satisfaction. Job satisfaction has been defined (Locke, 1976) as "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experience." Although management has an important role to play in meeting employee needs, there are some indications that job satisfaction attitudes may be more consistent over time than would be expected, given changes in the work environment (Staw & Ross, 1985). Also, to some degree, employees "bring a positive or negative disposition to the work setting, process information about the job in a way that is consistent with that disposition, and then experience job satisfaction or dissatisfaction as a result" (Staw, Bell, & Clausen, 1986). Similarly, it has been argued (Schmitt & Pulakos, 1985) that some personality characteristics create a predisposition for favorably evaluating aspects of the work environment. For this study, it was hypothesized that an increased curiosity level would be related to a more positive predisposition or anticipation of job satisfaction. Conversely, higher scores on both anxiety and anger subscales, as measured by the STPI, would correspond to a significant degree with lower self-expectations of job satisfaction.

The third purpose of this study was to examine and clarify the interrelationships among aptitude test results, STPI personality traits (anxiety, curiosity, and anger), job performance self-expectations, and FAA Academy nonradar screen performance. Newly-hired Air Traffic Control Specialists are required to successfully complete a nonradar screening program (pass/fail) at the FAA Academy in Oklahoma City prior to being assigned to an air traffic control facility, where they then are required to continue in phases of classroom, simulation, and on-the-job training. The "screen" measures aptitude for the ATCS occupation based on performance on paper-and-pencil tests and ability to apply air traffic control procedures in laboratory simulation problems.

The Multiplex Controller Aptitude Test (MCAT) has been used by the Federal Aviation Administration since 1981 as the primary selection test of a battery of tests administered to applicants for the ATCS occupation. The MCAT is a timed paper-and-pencil test in which the individual first examines tabular data about aircraft altitude, speed, and course, along with a map illustrating several aircraft at different locations on various flight paths. Applicants are required to correctly compute aircraft time-and-distance travel patterns and identify potential conflicts among flight paths. The predictive validity of the MCAT has been documented in various studies (Della Rocco & Manning, 1990; Schroeder, Dollar, & Nye, 1990; Manning, Kegg, & Collins, 1988; VanDeventer, Collins, Manning, Taylor & Baxter, 1984; and Sells, Dailey, & Pickrel, 1984).

Anxiety, measured as a personality trait using the State-Trait Personality Inventory, was found to be inversely related to a) successful completion of the FAA Academy nonradar program in the en route option prior to 1986 and b) achieving full performance level as an ATCS after field training (Collins, Schroeder, & Nye, 1989).

Those trainees who reported above-average performance self-expectations for themselves as ATCSs at the beginning of Academy screen programs were later found to have higher actual pass rates (Collins, Nye, & Manning, 1990; VanDeventer, Collins, Manning, Taylor, & Baxter, 1984). These expectations were defined and measured based on a self-projection of effectiveness (relative to peers) both in future training and at the full performance level as air traffic controllers.

A recent model of work attitudes, motivation, and performance (Katzell & Thompson, 1990) postulated that ability-related resources directly affect both performance and *expectancy*; the later term was defined by Campbell and Pritchard (1976) as the subjective likelihood that a given level of individual effort will result in the achievement of a performance goal. Also, an individual's perceptions of having the personal resources, including cognitive and behavioral skills, that are necessary to accomplish a goal have been termed *self-efficacy* (Bandura, 1982). Perceived self-efficacy was found to help explain numerous motivations, achievement strivings and career goals, for example. Thus, one specific hypothesis tested in the current study was that there existed a positive and significant relationship between performance self-expectations and

actual training performance, which could be explained as the function of a) aptitude, as reflected by selection test (MCAT) scores, and b) the trait anxiety construct, a component of which directly involves the lack of self-esteem and self-confidence.

METHODS

The State-Trait Personality Inventory (STPI) was given to the students who entered the FAA Academy nonradar screen program between October 1986 and September 1987. Also, a biographical questionnaire (BQ) was completed at the same testing session during the first week of attendance at the FAA Academy. A total of 1,482 subjects completed both the BQ and STPI. Of that total, 1,284 finished the FAA Academy screen and received a final grade. Entrants who withdrew prior to completion of the screen were not given a final grade. Those who had previously attended the FAA Academy and had failed or withdrew ("recycled") were excluded from the sample.

The STPI is comprised of a total of 60 items, divided into six subscales. The scores for three "trait" subscales are determined by the frequency (i.e., almost never, sometimes, often, and almost always) of each emotion, while the "state" subscales ask the respondent to indicate how he/she feels at the present time (i.e., not at all, somewhat, moderately so, and very much so). The total scores for each subscale are obtained by summing the item responses, giving a range of possible scores from a minimum of 10 to a maximum of 40. The Cronbach (alpha) reliabilities ranged from .86 for state anxiety to .66 for the state anger scale. For this study, only the trait effects of the STPI on Academy screen performance were evaluated (anxiety, $\alpha = .77$; curiosity, $\alpha = .82$; and anger, $\alpha = .76$).

The BQ that was administered was comprised of 145 items that addressed various aspects of the entrant's background (for example, education and aviation-related experience) and current attitudes regarding his/her career goals and expectations.

Anticipated job satisfaction was measured by self-reported responses, using a five-point scale from "not at all" to "a very great extent," to three items from the Biographical Questionnaire:

- a) Do you expect that working for the federal government will be desirable?

TABLE 1: Means, Standard Deviations, and Group Comparisons of State-Trait Personality Inventory (STPI) Scores - Anxiety, Curiosity, and Anger Scales

	Normative Groups					
	College Students		Navy Recruits		ATCS Trainees	
	Men	Women	Men	Women	Men	Women
	n = (95)	(185)	(198)	(72)	(1237)	(274)
<u>Trait Anxiety</u>						
Mean	17.88	19.38	19.17	19.24	14.86	15.08
SD	4.47	5.65	5.14	5.56	3.54	3.30
t value	-6.43*	-9.33*	-11.38*	-6.07*		
<u>State Anxiety</u>						
Mean	17.95	19.06	24.05	23.88	16.22	15.71
SD	5.52	6.25	7.14	7.94	4.80	4.61
t value	-2.96	-6.24*	-14.90*	-8.37*		
<u>Trait Curiosity</u>						
Mean	29.67	29.30	28.72	31.10	31.27	31.66
SD	5.05	4.53	5.10	4.97	4.22	3.95
t value	3.08*	5.76*	6.68*	0.89		
<u>State Curiosity</u>						
Mean	26.85	26.17	27.12	30.83	30.08	30.25
SD	5.72	5.45	6.35	5.73	5.65	5.28
t value	5.31*	7.97*	6.18*	0.88		
<u>Trait Anger</u>						
Mean	18.65	19.14	20.88	19.63	16.03	15.93
SD	5.06	4.97	5.73	5.32	3.49	3.55
t value	-4.96*	-7.58*	-11.57*	-5.58*		
<u>State Anger</u>						
Mean	13.42	14.24	17.38	15.07	10.38	10.18
SD	5.38	5.75	7.27	6.38	1.45	0.61
t value	-5.49*	-9.57*	-13.51*	-6.50*		

* Separate variance t-test statistic significant at $p < .001$ for same-gender comparisons between the normative groups and the ATCS trainees.

b) Do you expect that management will be supportive of your concerns?

b) Of all the air traffic controllers in the country, at what percentile do you think you will be able to perform? (5-point scale ranging from "the lowest 10%" to "the top 10%").

c) Do you expect to be satisfied with your job?

For this study, performance self-expectations were measured by the self-reported responses to the following two items:

a) How long do you think that it will take you to become fully effective in your current job? (5-point scale ranging from "much longer than most others" to "much less time than most others"),

The entrants' scores were obtained for the Multiplex Controller Aptitude Test (MCAT). Also, the entrants' subsequent Academy screen results (successful completion, failure, or withdrawal) and the final Academy grades were available from a database maintained in the Human Resources Research Division at the Civil Aeromedical Institute (CAMI).

TABLE 2: Multivariate Analysis of Variance Assessing Relationships of STPI Trait Measures with Trainee Self-Expectations of Job Satisfaction Levels

<u>Group Effect</u>	<u>Trait Scales in z Scores</u>			<u>N</u>
	<u>T-Anx</u>	<u>T-Cur</u>	<u>T-Ang</u>	
	<u>Mean</u>	<u>Mean</u>	<u>Mean</u>	
Job Satisfaction Expect.- Moderate or Limited	.258	-.278	.139	442
Job Satisfaction Expect.- Considerable or Great	-.120	.129	-.064	950
Total sample	.000	.000	.000	1392

Bartlett test of sphericity (3,1390) = 318.38, $p < .001$

	<u>Multivariate Test</u>		<u>Univariate Tests</u>	
	<u>F</u>	<u>Sig.</u>	<u>F</u>	<u>Sig.</u>
Hotelling	25.55	< .001	T-Anx	44.37
			T-Cur	51.77
			T-Ang	12.45

RESULTS AND DISCUSSION

The results of group comparisons of ATCS trainees with samples of college students and Navy recruits from Spielberger (1979) are shown in Table 1. Because the variances of the scale scores were not found to be equal (i.e., the scale standard deviations were lower for both men and women ATCSs), separate variance t -tests were performed. The comparisons were by gender and each comparison indicated that men and women ATCS trainees reported less trait and state anxiety than did Spielberger's samples (t values, -2.96 to -14.90). Similarly, lower levels of both trait and state anger were reflected in each comparison by t values -5.49 to -13.51. Also, the ATCS sample reported greater trait and state curiosity in most of the between-group comparisons (t values, 0.89 to 7.97). In other words, significant differences ($p < .001$) were found in all but two of the 24 between-group, by-gender comparisons.

There were no significant gender group differences within our ATCS sample for any of the trait or state measures. This last finding contrasted with gender differences in trait anxiety, which occurred in the normative group of college students and also in a study of community volunteers (Stoner & Spencer, 1986) in which women indicated higher levels of trait anxiety.

Personality Characteristics and Job Satisfaction Disposition. A multivariate analysis of variance (Table 2) was conducted using standardized scores (z scores) for the three personality trait subscales for a dichotomy of groups based on self-expected job satisfaction (to a "considerable" or "very great" extent and to a "moderate" or "limited" extent). This procedure also allowed for the determination of effect size differences on the STPI dimensions between the two groups. The Hotelling multivariate test for job satisfaction expectation groups was significant ($F=25.55, p < .001$): the univariate tests indicated that the differences were most prominent in the curiosity ($F=51.77, p < .001, d=.41$) and anxiety ($F=44.37, p < .001, d=.38$) scale scores and secondarily in the anger ($F=12.55, p < .001, d=.20$) dimension. These findings were consistent with the hypothesized results; the curiosity personality dimension being positively, but the anxiety and anger dimensions being negatively, associated with self-expectations of employees' future job satisfaction.

For a more descriptive representation of the relationships between STPI scales and the future job satisfaction criterion, the standardized scores for trait anxiety, trait curiosity, and trait anger for the sample were recoded into categories: less than -1.0, -1.0 to zero, zero through 1.0, and greater than 1.0. Table 3 shows the percentages of students within the job

TABLE 3: STPI Trait Scale Levels and Job Satisfaction Self-Expectations

Curiosity - χ^2 (43.96), $p < .001$, $N = 1,486$

Extent of expected Job Satisfaction as an ATCS

	<u>Moderate or limited</u>	<u>Considerable or very great</u>
z Scores < -1.0	45.4%	54.6%
-1.0 to 0.0	35.4%	64.6%
0.0 thru 1.0	28.7%	71.3%
z Scores > 1.0	20.0%	80.0%
Total	32.5%	67.5%

Anxiety - χ^2 (42.58), $p < .001$, $N = 1,486$

	<u>Moderate or limited</u>	<u>Considerable or very great</u>
z Scores < -1.0	21.7%	78.3%
-1.0 to 0.0	29.0%	71.0%
0.0 thru 1.0	34.5%	65.5%
z Scores > 1.0	48.2%	51.8%
Total	32.5%	67.5%

Anger - χ^2 (12.99), $P < .01$, $N = 1,486$

	<u>Moderate or limited</u>	<u>Considerable or very great</u>
z Scores < -1.0	26.2%	73.8%
-1.0 to 0.0	30.2%	69.8%
0.0 thru 1.0	36.2%	63.8%
z Scores > 1.0	40.2%	59.8%
Total	32.5%	67.5%

TABLE 4: Effects of STPI Personality Traits, ATC Aptitude Test Scores, Education Level, Military ATC Experience, Gender, and ATCS Self-Performance Expectations on Future Job Satisfaction

	T-Cur	Educ	T-Anx	T-Ang	JobExp	MilATC	Gender	MCAT
T-Cur	---							
Educ	.00	---						
T-Anx	-.34	.05	---					
T-Ang	-.12	-.05	.39	---				
JobExp	.18	-.09	-.26	-.04	---			
MilATC	.01	-.28	-.09	.07	.15	---		
Gender	.03	.05	.02	-.02	-.11	-.09	---	
MCAT	-.05	.04	.02	-.05	.14	-.19	-.12	---
JobSat	.30	-.12	-.24	-.14	.16	.09	.00	.00

Variable	Beta Weight	F	Signif.
T-Curiosity	.24	79.10	$p < .001$
Education Level (1=H.S., 2=Assoc. Deg., 3=Bach. Deg., 4=Post Grad)	-.11	15.34	$p < .001$
T-Anxiety	-.10	10.23	$p < .001$
T-Anger	-.08	7.96	$p < .01$
Job Performance Expectations as ATCS	.07	6.79	$p < .01$
Military ATC Experience (No=0, Yes=1)	.05	3.01	
Gender (Men=1, Women=2)	.01	.26	
ATC Aptitude Test Score (MCAT)*	.01	.19	

Multiple R = .36, $F(8,1347) = 26.14$

* MCAT - Multiplex Controller Aptitude Test selection test for ATCS applicants.

Note: The dependent variable (JobSat) - future job satisfaction - is the mean of three items from the Biographical Questionnaire involving the extent of expected a) desirability of working for the federal government, b) management support of employee concerns, and c) overall job satisfaction.

satisfaction expectation groups. The effect of curiosity on job satisfaction self-expectations ($x^2(3) = 43.96, p < .001$) was reflected in the finding that 80.0% of the students who had trait curiosity scores that were at least one standard deviation higher than the ATCS mean expressed greater likelihood of job satisfaction. Conversely, only about one-half (51.8%) of the group with trait anxiety scores and 59.8 % of those with anger scores (at least one standard deviation above our sample norm) expected to be satisfied with their jobs as ATCSs.

Table 4 presents a correlation matrix and results of regressing the future job satisfaction criterion measure on not only the STPI scale scores, but also other potentially relevant and interrelated variables; including MCAT scores, subjective performance expectations, and several demographic items (gender,

educational level, and military air traffic control experience). The beta weights of the variables were examined to estimate the relative importance of the association of these variables with self-expectations of future job satisfaction. The beta weights indicated that trait curiosity ($B=.24, F=79.10$) tended to correspond most significantly with anticipated job satisfaction, while gender, aptitude test scores, and prior military experience were not significant predictors in the regression equation. As found in previous analyses, increasing anxiety and anger levels were related inversely with self-expectations. Job performance self-expectations were significantly, and positively associated with self-expectations of job satisfaction. Also, a significant but small ($B = -.11, F = 15.34$) inverse effect was indicated for educational level and the job satisfaction criterion.

TABLE 5: Multivariate Analysis of Variance Assessing Relationships of STPI Trait Measures with Trainee Self-Expectations of Future ATCS Performance Level

<u>Group Effect</u>	<u>Trait Scales in z Scores</u>			<u>N</u>
	<u>T-Anx</u>	<u>T-Cur</u>	<u>T-Ang</u>	
	<u>Mean</u>	<u>Mean</u>	<u>Mean</u>	
Performance Expect.-Average or Lower	.276	-.144	.027	508
Performance Expect.-Above Average	-.158	.083	-.016	884
Total sample	.000	.000	.000	1392

Bartlett test of sphericity (3,1390) = 342.17, $p < .001$

	<u>Multivariate Test</u>		<u>Univariate Tests</u>	
	<u>F</u>	<u>Sig.</u>	<u>F</u>	<u>Sig.</u>
Hotelling	24.19	< .001	T-Anx	63.48 < .001
			T-Cur	16.57 < .001
			T-Ang	0.59 > .05

Personality Characteristics, Performance Expectations, and Academy Screen Results. A multivariate analysis of variance (Table 5) was conducted using the standardized scores (z scores) for the three personality trait subscales for a dichotomy of groups, based on subjective performance expectations of "above average" and "average or lower" compared with other ATCSs. The Hotelling multivariate test for performance self-expectation groups was significant ($F=24.19, p<.001$) with the univariate tests indicating that the differences were most prominent in anxiety scores ($F=63.48, p<.001, d=.43$), and secondarily in curiosity level ($F=16.57, p<.001, d=.23$).

The strongest effect on performance self-expectations was anxiety ($\chi^2(3)=69.03, p<.001$), reflected in the finding that 76.3% of the students who had trait anxiety scores that were at least one standard deviation lower than the ATCS mean also expressed above average performance expectations (Table 6). Conversely, less than one-half (46.0%) of the group with trait anxiety scores at least one standard deviation higher than our ATCS sample mean expected above average job performance. Trait curiosity was also significantly related to performance expectations ($\chi^2(3)=19.31, p<.001$), with higher curiosity reflected in greater confidence. The relationship

between the trait anger characteristic and the criterion measure was not significant as indicated by $\chi^2(3)=2.78, p>.05$.

Table 7 presents a correlation matrix and the results of a multiple regression analysis with the trainees' performance self-expectation criterion and the following variables: the STPI trait measures, the scores on the Multiplex Controller Aptitude Test (MCAT), previous experience (yes/no) in military air traffic control, educational level, and gender. The beta weights indicated that higher trait anxiety ($B=-.23, F=63.94$) tended to correspond to lower performance self-expectations. Also there was a small effect ($B=-.07, F=8.53$) in the regression equation for gender, with women reporting lower job self-expectations than did men. By contrast, previous military experience, higher MCAT scores, and greater curiosity were positively related and added significantly to prediction of the criterion.

Table 8 shows the Academy screen pass rates of our sample grouped by MCAT score level and STPI trait level. The dichotomy of trait scores was based on "high" equalling the level of one rounded-point above the mean scores of the normative groups (anxiety - 20, anger - 21, curiosity - 30). Consistent with previous results, relatively small percentages

TABLE 6: STPI Trait Scale Levels and Trainee Performance Self-Expectations

Anxiety - χ^2 (69.03), $p < .001$, $N = 1,486$

Performance Self-Expectations compared with other ATCSs

	Average or Lower	Above Average
z Scores < -1.0	23.7%	76.3%
-1.0 to 0.0	29.8%	70.2%
0.0 thru 1.0	44.1%	55.9%
z Scores > 1.0	54.0%	46.0%
Total	37.1%	62.9%

Curiosity - χ^2 (19.31), $p < .001$, $N = 1,486$

	Average or Lower	Above Average
z Scores < -1.0	45.5%	54.5%
-1.0 to 0.0	39.9%	60.1%
0.0 thru 1.0	33.5%	66.5%
z Scores > 1.0	29.1%	70.9%
Total	37.1%	62.9%

Anger - χ^2 (2.78), $p > .05$, $N = 1,486$

	Average or Lower	Above Average
z Scores < -1.0	32.2%	67.8%
-1.0 to 0.0	37.2%	62.8%
0.0 thru 1.0	37.8%	62.2%
z Scores > 1.0	40.1%	59.9%
Total	37.1%	62.9%

TABLE 7: Effects of STPI Personality Traits, ATC Aptitude Test Scores, Education Level, Military ATC Experience, and Gender on ATCS Job Performance Self-Expectations

	T-Anx	MCAT	MilATC	T-Cur	Gender	T-Ang	Educ
T-Anx	---						
MCAT	.02	---					
MilATC	-.09	-.19	---				
T-Cur	-.34	-.05	.01	---			
Gender	.02	-.12	-.09	.03	---		
T-Ang	.39	-.05	.07	-.12	-.02	---	
Educ	.05	.04	-.28	.00	.05	-.05	---
JobExp	-.26	.14	.15	.18	-.11	-.04	-.09

Variable	Beta Weight	F	Signif.
T-Anxiety	-.23	63.94	$p < .001$
ATC Aptitude Test Score (MCAT)*	.18	46.81	$p < .001$
Military ATC Experience (No=0, Yes=1)	.14	28.22	$p < .001$
T-Curiosity	.12	18.87	$p < .001$
Gender (Men=1, Women=2)	-.07	8.53	$p < .01$
T-Anger	.06	5.24	$p < .05$
Education Level (1=H.S., 2=Assoc. Deg., 3=Bach. Deg., 4=Post Grad.)	-.03	1.58	

Multiple R = .37 F(7,1349) = 30.92

* MCAT - Multiplex Controller Aptitude Test selection test given to ATCS applicants.

Note: The dependent variable (JobExp) - job performance self-expectations - is the mean of two self-report items from the Biographical Questionnaire involving the: a) expected length of time needed to become effective in the job, and b) future job performance level relative to other ATCSs.

of ATCS entrants reported trait anxiety (9.4%) and trait anger (9.7%) at the "high" levels. Pass rates were lower within each MCAT score level for those students with anxiety or anger levels above the normative levels. For both anxiety and anger levels, the effects were somewhat greater within the "high" MCAT group, with scores of 95.0 or greater: "high" trait groups had lower pass rates (11.2% lower for anxiety and 10.9% for anger). By contrast, trait curiosity level was not significantly related to success in the FAA Academy screen.

A path analysis was performed using LISREL VI (Joreskog & Sorbom, 1986) in which the following causal model was tested: aptitude test scores and trait personality scores were postulated as having direct effects on both the performance self-expectations and the Academy final grade criteria, and also the residual effect of performance self-expectations on Academy final grades could be determined. Comparing the significance of the path coefficients of MCAT scores and trait personality scores to Academy final grades determined the extent to which self-expectations mediated the relationship between the apti-

tude and personality measures with Academy screen performance. The correlation coefficients (Figure 1) were corrected (Thomdike, 1949) for the usual (for Academy entrants) severe restriction-in-range of aptitude test scores based on a ratio of 6.94/18.62 standard deviations for our ATCS sample to the original pool of applicants. The correlation and path analysis coefficients shown in the path diagram (Figure 1) are significant ($p < .001$) if .10 or greater. In this analysis, the MCAT score coefficient ($\gamma = .35$), anxiety ($\gamma = -.28$), and curiosity ($\gamma = .12$) accounted for 20.9% of the variance in performance self-expectations. Furthermore, the direct effects of MCAT scores ($\gamma = .51$) and trait anxiety ($\gamma = -.16$) were significant predictors of Academy final grades, accounting for 29.5% of the variance. A marked difference was between the corrected correlation coefficient for performance self-expectations and Academy final grades ($r = .24$, $p < .001$) and the direct effect ($B = .04$, $p > .05$) of performance expectations in the model. This finding indicated that, in this study, the predictive validity of performance self-expectations could be explained as being a function of the ATC aptitude test scores (MCAT) and the personality trait measure of anxiety.

TABLE 8: Academy Screen Pass Rates for MCAT and STPI Levels

GROUPS	Anxiety		Anger		Curiosity	
	% Pass Screen	% of Sample	% Pass Screen	% of Sample	% Pass Screen	% of Sample
Lower MCAT- High Trait	46.0	4.9	49.4	6.0	56.1	42.1
Lower MCAT- Lower Trait	56.6	56.0	56.5	54.9	55.0	18.8
High MCAT- High Trait	63.8	4.5	63.8	3.7	72.4	25.7
High MCAT- Lower Trait	75.0	34.6	74.7	35.4	76.2	13.4

Note: (n = 1,284), Multiplex Controller Aptitude Test (MCAT) levels are "Lower" = 70-95 and "High" = 96-112.

State Trait Personality Inventory (STPI) "Lower" levels are trait anxiety < 20, trait anger < 21, and trait curiosity < 30.

CONCLUSIONS

The results of this study confirm earlier findings (Collins, Schroeder, & Nye, 1989), that recently employed ATCS trainees continued to have a personality profile that is relatively low in anxiety. Also, our sample was low on the anger dimension but high on the curiosity measure of the STPI. This finding could be a further example of applicant self-selection and/or the nature of the selection process itself. Significant gender differences for ATCS trainees were not found on any of the STPI dimensions, a finding consistent with previous research, e.g., Karson and O'Dell (1974), which found that the personality profiles of men and women interested in the air traffic control occupation were more similar than dissimilar.

With respect to self-expectations of future job satisfaction, significant differences were found in the perceptions of newly hired air traffic controllers. Since the sample for this study included only first-time Academy entrants and the self-expected job satisfaction items were completed at the beginning of the ATCS screen program, many potential situational factors were mitigated that could affect job satisfaction. Thus, these results suggest that the potential exists for some degree of biased affect (or predisposition) regarding future job satisfaction and that some of the variability is reflected by the STPI dimensions. Specifically, greater future job satisfaction was associated with higher levels of curiosity but lower levels of the anxiety and anger personality dimensions.

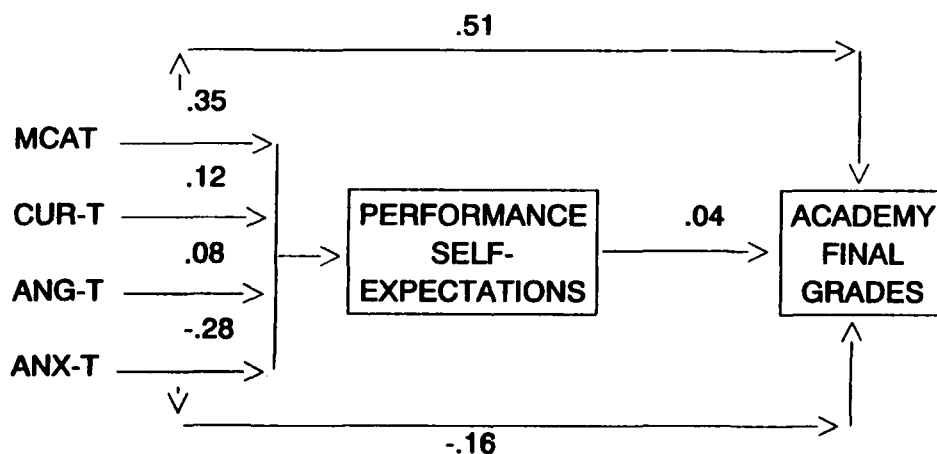
For the last issue of this study, both ATCS job performance self-expectations and Academy screen performance were related to aptitude test scores and to trait anxiety levels. The predictive validity of the MCAT was demonstrated to have been impacted by the anxiety personality dimension. It was found that, to some extent, future performance self-expectations (conceptualized as a measure of self-efficacy) reflected a realistic self-evaluation of future job performance (success in the Academy screen) at an initial stage in the trainees' careers. Also, the impact of self-efficacy on Academy screen performance could be explained in terms of relative ability (MCAT test scores) and personality characteristics (absence of anxiety) found in successful air traffic controllers.

FIGURE 1: Correlation Matrix and Path Analysis of STPI Measures, Aptitude Test Scores, Job Performance Self-Expectations, and Final Academy Grades

	<u>PerfExp</u>	<u>Grades</u>	<u>Anx-T</u>	<u>Cur-T</u>	<u>Ang-T</u>
PerfExp	---				
Grades	.24	---			
Anx-T	-.27	-.11	---		
Cur-T	.18	-.04	-.33	---	
Ang-T	-.04	-.02	.40	-.12	---
MCAT	.33	.52	.03	-.05	-.05

Note: Coefficients are corrected for restriction-in-range of aptitude test (MCAT) scores.

Structural Path Coefficients
(Maximum Likelihood)



Note: MCAT= Multiplex Controller Aptitude Test; PERFEXP= Job Performance Self-expectations; ANX-T= Trait Anxiety; ANG-T= Trait Anger; CUR-T= Trait Curiosity. Path coefficients of .10 or greater were significant ($n=1142$, $p<.001$).

REFERENCES

- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, 37, 122-147.
- Campbell, J. P., & Pritchard, R. D. (1976). Motivation theory in industrial and organizational psychology. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 63-130). New York: John Wiley and Sons.
- Cattell, R. B., Eber, H. W., & Tatsuoka, M. M. (1970). *Handbook for the 16PF. Institute for Personality and Ability Testing*. Champaign, IL.
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. New York: Academic Press.
- Collins, W. E., Schroeder, D. J., & Nye, L. G. (1989). *Relationships of anxiety scores to Academy and field training performance of Air Traffic Control Specialists*. Washington, D. C.: Federal Aviation Administration Report No. DOT/FAA/AM-89-7.
- Collins, W. E., Nye, L. G., & Manning, C. A. (1990). *Studies of poststrike Air Traffic Control Specialist trainees: III. Changes in demographic characteristics of Academy entrants and biodemographic predictors of success in air traffic controller selection and Academy screening*. Washington, D. C.: FAA Office of Aviation Medicine Report No. DOT/FAA/AM-90/4.
- Della Rocco, P. S., & Manning, C. A. (1990). *Selection of air traffic controllers for automated systems: Applications from current research*. Washington, DC: FAA Office of Aviation Medicine Report No. DOT/FAA/AM-90/13.
- Joreskog, K. G., & Sorbom D. (1986). LISREL VI: Analysis of linear structural relationships by the method of maximum likelihood: User's guide (4th ed.). Mooresville, IN: Scientific Software, Inc.
- Karson, S., & O'Dell, J. W. (1974). Personality differences between male and female air traffic controller applicants. *Aerospace Medicine*, 45(6), 596-598.
- Katzell, R. A., & Thompson, D. E. (1990). An integrative model of work attitudes, motivation, and performance. *Human Performance*, 3(2), 63-85.
- Locke, E. A. (1976). The nature and causes of job satisfaction. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*, (pp. 1297-1349). New York: John Wiley and Sons.
- Manning, C. A., Kegg, P. S., & Collins, W. E. (1989). Selection and screening programs for Air Traffic Control Specialists. In R. S. Jensen (Ed.), *Aviation Psychology* (pp. 321-341). Brookfield: Gower Technical.
- Myers, J. G., Schroeder, D. J., VanDeventer, A. D., & Collins, W. E. (1988). 1988 FAA job satisfaction survey: National report. Washington, DC: FAA Office of Aviation Medicine.
- Schmitt, N., & Pulakos, E. D. (1985). Predicting job satisfaction: Is there a general satisfaction factor? *International Journal of Psychology*, 20, 155-167.
- Schroeder, D. J., Dollar, C. S., & Nye, L. G. (1990). Correlates of two experimental tests with performance in the FAA Academy air traffic control nonradar screen program. Washington, D. C.: FAA Office of Aviation Medicine Report No. DOT/FAA/AM-90/8.
- Sells, S. B., Dailey, J. T., & Pickrel, E. W. (1984). *Selection of air traffic controllers*. Washington, DC: Federal Aviation Administration Report No. FAA-AM-84-2.

Spielberger, C.D. (1979). Preliminary manual for the State-Trait Personality Inventory. Inventory. Tampa, Florida: Human Resources Institute, U. of South Florida.

Staw, B. M., & Ross, J. (1985). Stability in the midst of change: A dispositional approach to job attitudes. *Journal of Applied Psychology*, 70, 469-480.

Staw, B. M., Bell, N. E., & Clausen, J. A. (1986). The dispositional approach to job attitudes: A lifetime longitudinal test. *Administrative Sciences Quarterly*, 31, 56-77.

Stoner, S. B., & Spencer, W. B. (1986). Age and sex differences on the State-Trait Personality Inventory. *Psychological Reports*, 59, 1315-1319. Thorndike, R. L. (1949). *Personnel Selection*. New York: Wiley and Sons.

VanDeventer, A. D., Collins, W. E., Manning, C. A., & Taylor, D. K. (1984). *Studies of poststrike Air Traffic Control Specialist trainees: I. Age, biographical factors, and selection test performance related to Academy training success*. Washington, D. C.: Federal Aviation Administration Report No. FAA-AM-84-6.